

NOTES
ON THE
SMALL-POX EPIDEMIC
AT
BIRKENHEAD
IN 1877.

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WHEN a district has been visited by an outbreak of a zymotic disease which has proved wide-spread and fatal beyond all recent experience in the locality, it becomes the medical officer in charge, after he has made his formal report to his authority and the central board, to consider well, how the experience which he has gained in observing and dealing with the visitation, may be made available for others. Every epidemic has its own story, teaches its own special lessons, contributes its share to existing statistics; and particulars regarding it, cannot fail to be interesting to all engaged in the practice of public medicine. Now this, I take it, is especially true as regards every small-pox epidemic (the disease being admittedly preventible) and it is with reference to a small-pox epidemic I have now to solicit your attention. I have styled what I have written "notes," because it is necessarily fragmentary. The points I have sought to bring before you, are mainly :—

- I. The initial cases being concealed cases.
- II. The especial prevalence of the disease among children and young persons.
- III. The especial fatality of the disease among the unvaccinated.
- IV. The length of time between the first sense of illness, and the appearance of the eruption.
- V. The length of the incubation period.
- VI. The position of those affected in the families to which they belonged, their sex and occupation.

In 1877, the district of Birkenhead, in common with many other districts, urban and rural, suffered from an epidemic of small-pox. The last local epidemic was between May, 1870, and October, 1871, the resulting deaths being then 23; since which but two deaths have been referred to the disease—one in August, 1874, and one in September, 1876. From time to time sporadic cases are introduced into the district, by ships putting into dock, or from Liverpool or other Lancashire towns; but as prompt advice of such cases is nearly always received, the isolation of the infected subjects, and the other repressive measures adopted, have again and again proved sufficient to prevent the spread of the disease. In 1876, the cases of small-pox imported into the town were unusually frequent, that is to say, from the beginning of the year up to November 26th there were eleven patients, eight of whom were received into hospital, and three (members of one family) treated at home. Not one of these patients was in any way connected with the epidemic of 1877; those treated at home were well early in September, and by the end of November there were but two in hospital, the case admitted on the 26th and one convalescent. Now during the last week of the year 1876 no less than seven cases were notified to the authority; and as for upwards of four weeks before, no case had been reported or come to the knowledge of the sanitary or parish authority, and the only remaining cases of those previously noticed were isolated in hospital, it seems certain that one or more of these seven originated the outbreak. Of the seven, two were reported on December 25th, one on the 26th, one on the 27th, two on the 28th, and one on the 29th. The second, third and fourth cases reported, appear to have been removed to hospital almost as soon as recognized, while the fifth and sixth were transferred to the union hospital after the lapse of one day. The remaining two, the first and last reported, were deliberately concealed. The first, which I shall call the Cleveland Street case, was not reported till it had been received into the union hos-

pital. The history of the case is as follows:—The patient was a barmaid in the employ of her aunt, who kept a small public-house in Watson Street. On or about Dec. 19th, while living in this house, she sickened with small-pox, and on the 24th, being then very ill, she went home to her mother, who rented a room in a large sub-let house in Cleveland Street. Here she remained but one night, admission to the union hospital being obtained for her next day, but the result of the one night's lodging was that on January 11th, a younger sister (a child of 8 living with the mother) sickened with small-pox, and she in turn communicated the disease to the mother, who manifested a well pronounced eruption on January 26th. Meanwhile, a servant employed in the public-house in Watson Street, who had all along occupied the same bed-room as the barmaid, began to show signs of being infected, and on January 3rd, there being then no doubt about the nature of the disease, the landlady became alarmed, and made arrangements with a woman, who had been from time to time employed by her as a charwoman, to receive the patient. The charwoman accordingly accepted the charge, and on the night of the 3rd the patient was lodged at the charwoman's house in Kinnel Street, from which she was removed by the parish authorities on the 4th. There was no subsequent case in this house, but on the 20th, a lad living in the same street and not many doors off, was reported ill with confluent small-pox, and though proof is wanting that this lad was in the company of the infected woman, or those who received her, it is at least a remarkable coincidence, that about a fortnight after the woman visited the street (which is a very small one) the rash began to appear on this poor lad. There can be little doubt as to the motive which influenced the public-house mistress, in acting as she did. Her house was doing a brisk Christmas trade and she did not wish to spoil it. Clearly the patients must be got rid of; but had she applied to have them removed to the fever hospital, she would have had to pay maintenance charges in

respect of them ; and had she appealed to the parish authority, there might have been some difficulty in effecting the transfer, at all events in the case of the niece. The easiest and simplest course to pursue was to shift the burden from her own shoulders to those of others, and this was done twice successfully, as I have shown.

The other case I have referred to, and which I shall call the Conway Street case, although it did not come to the knowledge of the sanitary authority till December 29th, appears to have sickened about a week before Christmas, the eruption being first visible on the 22nd. The lower portion of the premises in which this case occurred, had unfortunately been opened as cocoa-rooms a day or two before the disease declared itself ; and apart from this, the house was one in which a concealed case of small-pox was almost certain to do mischief. On Sundays, a Sunday school was held there, and on various days in the week it was used as a meeting-house by Foresters, Good Templars, a trade society, a co-operative society, and three tontine clubs. Here, as in the cases originating in Watson Street, a medical man had been called in, and small-pox was recognized ; but the disease was considerably modified by vaccination, and the friends may on this account have been blinded as to the risk incurred. On the representation of the sanitary authority, the house was at once closed, and the patient isolated as far as practicable ; but on January 12th, that is just fourteen days after the closing of the house, a young woman who lived with the family and assisted in the business, showed the characteristic rash, and was transferred to the fever hospital. Whether the concealed case in Conway Street was the means of spreading the disease to any of those who frequented the house before it was closed, is difficult to ascertain ; but that the small-pox was thus communicated is extremely probable, and in one instance a patient's friends attributed a fatal attack to visits to the cocoa-rooms, and no other source of infection could be traced. This case was reported in January 11th, admitted to the union hospital

on the 12th, and died on the 21st. These brief particulars of cases, which were deliberately concealed, need no comment. The necessity for a measure making timely information of cases of infectious disease compulsory, has been frequently represented. Facts, such as I have just recorded, show that the demand for assistance in this respect, from the Legislature, is reasonable. The two cases in Watson Street, silyly hustled away to two virgin houses, and the case hidden in the upper story of the busy house in Conway Street, were all in medical charge, and had been correctly diagnosed. I could cite many other instances where the subjects of small-pox have been concealed, but in those I have brought forward concealment was probably exceptionally mischievous.

The next point I am desirous of calling attention to, is the especial prevalence of the disease among children and young persons. The total number of cases coming to the knowledge of the authority in 1877, was 603, 190 being reported during the first quarter, 313 during the second quarter, and 100 during the latter half of the year. In four cases only the age of the affected subjects was not ascertained. On arranging the ages in tabular form, thus :—

BIRKENHEAD SMALL-POX EPIDEMIC IN 1877.

Number of cases reported from month to month arranged according to age of subjects.

1877.	Cases reported.	AGE BELOW.				Age unknown.
		1	5	20	60	
January	39	1		21	17	
February	57	2	3	29	23	
March	94	6	5	38	45	
April... ..	102	5	4	49	42	2
May	101	6	7	52	36	
June	110	5	10	44	49	2
July	48	3	5	29	11	
August	33	2		17	14	
September	11	2		3	6	
October	7			4	3	
November... ..	1			1		
TOTAL... ..	603	32	34	287	246	4

it was found that 5·3 per cent. of the whole number attacked were infants under one year, 5·6 per cent. were one year and upwards, and under five years, 47·5 per cent. were five years and upwards, and under twenty, and but 40·7 per cent. were twenty years old and upwards. It was also noticed that the proportion of adults to the whole number of cases reported, gradually declined. Thus, in the first quarter of the year, the proportion of persons twenty years old and upwards, to the total of persons reported during the quarter, was 44·7 per cent., during the second quarter of the year, it was 40·5 per cent., and during the latter half of the year it was 34 per cent. The percentage of children and young persons among those attacked, does not however fairly indicate the special prevalence of the disease among the young, as in nearly all localities the adults outnumber those under twenty years of age. To ascertain the relative susceptibility to attack of infants, children, young persons and adults, as indicated by the Birkenhead epidemic, it is requisite to compute the number of infants, children, young persons and adults, in the local population, at the middle of the year. This is a comparatively simple matter, as the exact number coming within each age period appears in the last Census return, and there is no reason to believe the local population is not essentially the same, in this respect, as it was at the date of enumeration. On this basis, we find that out of every 1,000 infants under twelve months, 16·6 were attacked with small-pox, that out of every 1,000 children one year old and under five years, 5·3 were attacked, that out of every 1,000 children and young persons turned five years, and under twenty, 15·9 were attacked, and out of every 1,000, twenty year old and upwards, 8·8 were attacked. Not a single person of sixty years old or upwards was attacked, although it is estimated there were 2,316 persons of this age living in Birkenhead at the time of the epidemic. The large proportion of infants affected, is manifestly due to the relatively large number of them unvaccinated, 27 out of a total of 32 under one year

old being unvaccinated, and one vaccinated only 5 days before the appearance of the rash. It is fair to add, that 21 out of the 32, were but three months old or under, eight being under four weeks. Of course the fatality of the disease among infants attacked, was enormously high—22 (*i.e.*, 68 per cent.) dying.

This brings me to the third subject, on which I have prepared some notes—the especial fatality of the disease among the unvaccinated. It is much to be regretted that the information obtainable, as to the protected or unprotected state of the affected, is not more precise. Such information as I have, consists of extracts from the registers of the two local hospitals, and the register of the unremoved cases, and is summarized in the following table :—

DESTINATION AND RESULT.	Vaccinated.	Not Vaccinated.	Unknown.
FEVER HOSPITAL	87	15	4
UNION HOSPITAL	43	19	33
NOT REMOVED	93	38	183
TOTAL RECOVERED	223	72	220
FEVER HOSPITAL	5	9	0
UNION HOSPITAL	2	10	15
NOT REMOVED	5	34	13
TOTAL DIED	12	53	28

The particulars are far from complete, but so far as they go it is believed they are quite reliable. Thus, as regards the patients admitted to the fever hospital or treated at home, those entered as vaccinated displayed undoubted cicatrices, as attested by competent medical witnesses, and those entered as not vaccinated were admittedly unvaccinated, or without the faintest mark. The mere assertions of patients or their friends, that they were vaccinated, counted for nothing, as about eighty per cent. of the patients entered in the third column of the table, were reported as having been vaccinated in infancy. The testimony of the table in favour of the value of vaccination as modi-

fyng small-pox, may be thus stated :—Out of 515 patients who recovered, 223, or 43·3 per cent., were known to have been vaccinated, and 72, or 13·9 per cent., were known to have been unvaccinated ; whereas out of the 93 patients who died of the disease, 12, or 12·9 per cent., were known to have been vaccinated, and 53, or 56·9 per cent., were known to have been unvaccinated. It is hardly necessary to say, that in many of the vaccinated subjects, the operation had been only partially successful. The analysis of the vaccination of the 87 vaccinated patients who recovered at the fever hospital, is as follows :—

12	showed each	1	faint mark.		
24	„	„	2	„	marks.
11	„	„	3	„	„
1	„		4	„	„
7	„	each	1	distinct	mark.
10	„	„	2	„	marks.
8	„	„	3	„	„
6	„	„	1	distinct	mark and 1 faint mark.
5	„	„	1	„	„ 2 „ marks.
2	„	„	2	„	marks 1 „ mark.
1	„		2	„	„ 2 „ marks.

The analysis of the vaccination of the 5 vaccinated patients who died at the fever hospital, is as follows :—

2	showed each	1	faint mark.
1	„	2	„ marks.
1	„	5	„ „
1	„	1	distinct mark.

What is the length of time between the first sense of illness and the appearance of the eruption ? This is a question which I think I may venture to say observers of small-pox epidemics have hitherto taken little trouble to determine. Certainly I know of no trustworthy statistics on the subject. It occurred to me at the commencement of the outbreak that either the patient or those in charge of him would generally be able to say when the first sense of illness was perceived. Accordingly, in the sheets for registering the cases as

reported a column was introduced headed "Date when patient sickened," the next column being headed, "Date when eruption began," and I found that in the majority of cases information was forthcoming to enable me to make entries in both these columns. Of the 603 cases known to the authority no less than 526 furnished particulars as to the date of sickening and the date of the commencement of the eruption. In one case the first sense of sickness was referred to fourteen days before the first indication of the eruption, and in one case to eight days before. This is the extreme limit. In none of the other cases did the period between sickening and eruption exceed one week, while it rarely exceeded four days. In 17 cases the first sense of illness was referred to the day on which the eruption began to appear, in 175 to the day before the eruption, in 166 to two days before, in 100 to three days before, in 40 to four days before, in 14 to five days before, in 4 to six days before, and in 8 to seven days before. That is to say, 3.2 per cent. of the patients furnishing particulars were either not ill before the appearance of the eruption, or ill for only a few hours before; whereas in 33.2 per cent. illness preceded the eruption by one day, in 31.5 per cent. by two days, in 19.0 per cent. by three days, in 7.6 per cent. by four days, in 2.6 per cent. by five days, and in 2.6 per cent. by a longer period.

What is the length of the incubation period? is a far more momentous question than that just considered, and it has received much more attention. The result is that authorities on the subject are nearly agreed; still, any evidence in this connection is instructive and useful. The period of incubation of an infectious disease, like the duration of utero-gestation, is exceedingly difficult to determine. Indeed, rarely as one is able to fix the date of impregnation, the opportunities for fixing the date when any particular subject received the contagium of small-pox are still more rare. If, therefore, out of the many hundred cases of small-pox observed by me during 1877 I am able to determine

the incubation period to your satisfaction in three or four cases only, I shall esteem myself fortunate. As the sources of error multiply with the spread of the disease, I have turned my attention especially to some of the early cases. But first let me define what I understand by "the period of incubation." With some writers it means the period intervening between the receipt of the morbid principle into the system and the supervention of distinct symptoms. Now as a rise of temperature of 3 or 4 degrees is a distinct symptom, and may precede the eruption, I prefer to define the incubation period as the time between exposure to infection and the commencement of the eruption. The first case I shall consider is that of Sarah B——, a child 8 years old, who lived in a house in Cleveland Street with her mother. I find no difficulty in referring the attack from which this little girl suffered to a known source of infection, inasmuch as she was the sister of the initial patient of the epidemic. You may remember that I stated that a young woman employed as a barmaid in a public-house in Watson Street, went home to Cleveland Street on the afternoon of December 24th, where she remained one night only, being removed on the 25th to the union hospital. This night she slept in the same room with her mother and little sister, and on January 11th the latter became poorly, and two days later the characteristic eruption began to appear. The incubation period thus appears to have been 19 or 20 days. The next case is the mother of the two patients, who, I have already told you, manifested a distinct eruption on the 26th. This woman clearly caught the disease from one of her children. If from the elder it was upwards of a month declaring itself; if from the younger the period of incubation did not exceed 13 days. In the light of the testimony of authors as to the extreme limits of the incubation period there need be no reasonable doubt as to which daughter the mother derived the disease from. The third case I proceed to examine is a remarkably interesting one. Eliza O——, a child 10 years old, and having three good vacci-

nation marks, was admitted into the fever hospital on January 17th, at 9, p.m. She was suffering from scarlatina, but her friends were very desirous to have her taken in, though of course duly advised of the risk she incurred from the small-pox cases in hospital. On the afternoon of the 29th she appeared so well that she was told she could get up next day. On the 30th, however, she felt feverish, and remained in bed, and her temperature (previously normal) had risen to 104.6° . The next day a discrete eruption began to appear. This child came from a remote corner of the district, where there had been no small-pox, and there can be no doubt she caught it at the hospital. The period of incubation was therefore under 14 days. The patient was received at 9 p.m. on the 17th, and a few hours before this on the 31st the eruption was manifest. The next case, as it occurred much later in the year, and nearly in the centre of the town, is not as "strong" as any of the three just given; still it appears to me worth recording. In Queensbury Street, where there had been no previous case, a man manifested the eruption on February 17th, and died on the 25th, and a lad residing on the opposite side of the same street, but some distance higher up, first began to show signs of the commencement of the eruption on the 24th, and was removed to the hospital on the 26th. Now, on March 11th, this lad's sister (a girl of 13), living in the same house with him and his parents, began to develop a discrete eruption. This girl, as well as her brother, came under my care, and I entertain no doubt that she caught the affection from him, and if so the period of incubation was from 13 to 15 days. If she took it from the neighbour who died the period would then be from 14 to 22 days; but there is not a trace of evidence that the infection was thus communicated. The fifth and last case in which I have been able to ascertain the time elapsing between exposure to contagium and the appearance of the eruption is that of Sarah H——, a married woman, aged 40, residing with her family outside the borough boundary. This woman's husband

was sent into the fever hospital on May 29th, the eruption being then still coming out. It had barely commenced the day before, by his own account. On June 15th the rash appeared on the man's wife, and she was transferred to hospital at 5 in the afternoon. The incubation period here was therefore 17 or 18 days.

Bearing in mind my statement that all I intend to imply by incubation period is the time between exposure to infection and the commencement of the eruption, I think you will admit that here are certain incubation periods arrived at with tolerable precision. All five cases were seen by myself, the three last mentioned coming under my own charge. In all the eruption was discrete. Adding the particulars of vaccination, the record stands thus:—

Name of Patient.	Age.	Vaccination Particulars.	Time between exposure and commencement of eruption.
Sarah B.....	8	2 faint marks.....	19 to 20 days
Mary B.	44	1 faint mark	13 days
Eliza O.....	10	3 distinct marks	13½ days
Margaret M.....	13	no mark	13 to 15 days
Sarah H.....	40	1 distinct and 1 faint mark...	17 to 18 days

Had I been asked what was the incubation period of small-pox at the commencement of the epidemic, I should have answered that my experience and reading led me to believe that it was nearly always from 12 to 14 days. In deference to the particulars now submitted I think my answer to such a question would now be "nearly always from 12 to 20 days." I am aware that it may be urged with reference to the first and last cases that the utmost which is proved is that the incubation period did not exceed the time specified; and even then we have to presuppose the disease in the last case incommunicable before the eruption. The sister may not have communicated small-pox directly to the child; she may merely have left traces of contagium behind her which afterwards infected the child, and similarly the husband may not have communicated

his malady directly to his wife. This is, of course, possible; yet if a subject were so little susceptible to small-pox as to be able with immunity to sleep with a patient on which the eruption was manifest, it is scarcely probable that she would within a day or two become infected by something contaminated by the patient. I submit the record merely as a record, and knowing it actually proves very little. In any of the cases, for aught I know to the contrary, the poison may have been received into the system less than a week before it manifested itself; and inasmuch as no one can say the communicableness does not commence before the eruption, the second, fourth, and fifth cases may have been infected even before their infecters showed any cognizable sign of being affected.

Finally, I have to speak of the position in their respective families of those affected, as distinguishing breadwinners from dependents, and the occupations of the same, as indicating their social position.

Of the whole number of patients reported 338 were males and 261 were females, while in four cases the sex was not recorded. I took some pains to ascertain the position of these patients in the families to which they belonged. Of the males 68 appear as heads of houses, or parts of houses, 180 as dependents, or in part dependents, and 72 as lodgers; of the females 57 appear as wives or mothers (7 being nursing mothers), 168 as daughters or dependents, and 17 as lodgers. To be more exact the return under this head is as follows:—

<i>Males.</i>		<i>Females.</i>	
Husbands and fathers.....	55	Wives and mothers.....	47
Husbands	10	Wives	8
Widower and father	1	Widows and mothers.....	2
Bachelor householders.....	2		
Sons.....	176	Daughters	152
Nephews	2	Nieces.....	6
Grandson.....	1	Granddaughters.....	2
Servant	1	Servants	8
Lodgers.....	68	Lodgers	14
Lodgers' sons.....	4	Lodgers' daughters.....	3
Unascertained.....	18	Unascertained.....	19

As regards the occupations of those reported as suffering from small-pox, particulars were not returned

in every case; and the returns made include such a variety of occupations it is not easy to group them effectively. Among unskilled workers no less than 48 are described simply as labourers, and 35 as dock labourers, 9 as railway servants, 7 as policemen, 7 as porters, 9 as cart or van drivers, and six as car drivers, coachmen, or grooms. Among workers in iron I notice 6 boiler-makers, 10 smiths, drillers, fitters, &c., and 3 rivet lads. Thirteen are described as belonging to one or other of the building trades, and 5 were brickmakers. Three were described as seamen, and 10 as riggers, calkers, ship carpenters, &c. There were 5 beersellers or their *employés*, 5 butchers, 4 shoemakers, 2 drapers, 2 carriage builders, 2 gasfitters, 2 coppersmiths, a lead-grinder, 6 shop lads, 2 clerks, a gardener, a doctor, and a clergyman. In going over the occupations of the women affected I find no less than 35 described as servants. As 8 only were received from houses in which they were in service, the remainder must have been out of place at the time they were reported. Seven are described as shop assistants, 4 as dress-makers, 2 as milliners, 3 as seamstresses, 3 as bar-women, 3 as small shopkeepers, and 6 as chipsellers, and 24 young women were described as "helping" at home. The number contributed by the local denominational schools to the sum of the subjects affected was, as indeed might be expected, very large. There were two assistant teachers, one belonging to each sex, and 113 scholars, of whom 52 were boys and 61 girls.

Thus it appears that an overwhelming majority of the sufferers in this epidemic were derived from the labouring class, and the remainder—six only excepted—from the artisan class. The six exceptions are the two professional men and the two clerks referred to, an insurance agent and a shipbroker. The few instances in which particulars as to occupation were not ascertained were for the most part parish cases, so that had the return been complete it would scarcely have affected this conclusion.